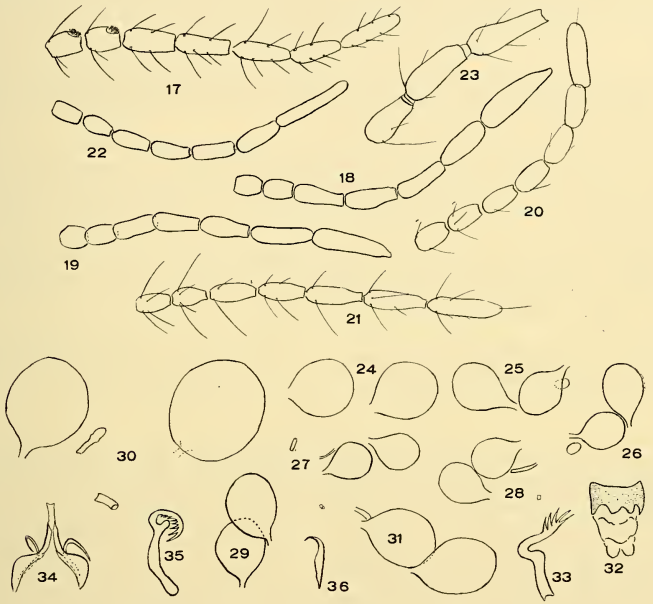
Male.

Wing pattern similar to female, macrotrichia almost absent. Third segment of palp divided like a boxing glove. In the genitalia the harpes are complex (Text-fig. 33) and the aedeagus as in Text-fig. 34.

Distribution.—Queensland: Texas, 20:i:1952 and 26:iii: 1952, light trap (A. L. Dyce). New South Wales: Bundy (type series); Noonameena, 8:i:1952, light trap (A. L. Dyce).



Text-figures 17-23.—Segments 9-15 of the antenna of various species (×190 approx.): 17, *C. coronalis.*[1] 18, *C. williwilli.* 19, *C. nattaiensis.* 20, *C. bunrooensis.* 21, *C. moreensis.* 22, *C. bundyensis.* 23, *C. waringi.*[2]

Figures 19, 21 and 22 are from holotypes, 17 is from a paratype (392), 18 a paratype (416), 20 a paratype (397), and 23 a paratype (441).

Text-figures 24-31.—Spermathecae of various species (×190 approx.): 24, *C. coronalis.* 25, *C. williwilli.* 26, *C. nattaiensis.* 27, *C. bunrooensis.* 28, *C. moreensis.* 29, *C. bundyensis.* 30, *C. waringi.* 31, *C. multimaculatus.*

Figures 24, 28 and 30 are from holotypes, 25 is from a paratype (415), 26 paratype (437). 27 a paratype (397), 29 is a specimen from Texas (430), and 31 a specimen from King Lake (411).

Text-figures 32-36.—(×190 approx.): 32, Terminal abdominal segments of ♀ *C. coronalis.* 33 and 34, Harpes and Aedeagus of *C. williwilli.* 35, Harpes of *C. nattaiensis.* 36, Harpes of *C. bundyensis.*

Figure 32 is from the holotype, figures 33-36 are from the allotypes.

Culicoides nattaiensis, n. sp.

Types: Holotype ♀, allotype ♂ and one ♀ paratype. All slide specimens in S.P.H.T.M.

Type Locality.—Stockyard Creek, Colo Vale, near Mittagong, New South Wales, 17:xi:1953, light trap (A. L. Dyce). This is near the headwaters of the Nattai River.

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[1] The sensory pits illustrated on the antenna of this species are also to be found in other species but were particularly obvious in *C. coronalis.*

[2] Only segments 10-12 are figured for this species.

Distinctive Characters.—This species is closely allied to *C. williwilli* but lacks the distinctive wing pattern of the latter. The wing pattern of *C. nattaiensis* is essentially similar to that of *C. robertsi*. However, in *C. nattaiensis* the third segment of the palp is considerably swollen (much smaller and not obviously expanded in *C. robertsi*). A possibility of confusion may also exist with *C. marmoratus*, but again the third segment of the palp is quite distinctive.

Description.—From the type series only. No pinned material available for details of coloration. Measurements from holotype and selected series comprising two paratypes. Male measurements from allotype only. (See Table 1.)

Female.

Femora with preapical pale spots, tibiae with subbasal ones. Halteres pale. Wings with well-contrasted pattern, as in Plate ix, fig. 3. Macrotrichia scanty, second radial cell almost obliterated, its veins thickened.

Head: Eyes separated above, contiguous below (Text-fig. 3). Antennae with basal segments almost globular, distal five cylindrical and decidedly longer, contrast well marked (Text-fig. 19). Third segment of palp swollen with large round pit on distal half, segments IV and V rather short (Text-fig. 11). Mouthparts not as long as height of head.

Thorax: Legs unmodified, tarsus IV subcylindrical, tibial comb of four spines.

Abdomen: Two fully developed subspherical spermathecae each with a distinct duct and one very small spermatheca (Text-fig. 26).

Male.

Similar to female on wing pattern and form of palp (cf. *C. williwilli*). Genitalia with complex harpes (Text-fig. 35).

Distribution: New South Wales: Only known from the type locality.

Culicoides bunrooensis, n. sp.

Types: Holotype ♀, allotype ♂ and 10 ♀ paratypes. All types in S.P.H.T.M. except four paratypes, one each in C.S.I.R.O., Q.I.M.R., B.M. and U.S.N.M.

Type Locality.—For holotype and all paratypes, Texas, Queensland, light trap, dusk to 2130 hours, 26:iii:1952 (A. L. Dyce); for allotype, Bundy, via Moree, New South Wales, light trap, 1:xi:1951 (A. L. Dyce).

Distinctive Characters.—The wing pattern of this species has some basic resemblance to *C. ornatus*, from which it may be distinguished by the dumb-bell-shaped pale area in the intercalary fork and the presence of pale areas over the extremities of M_1, M_2 and M_{3+4}. There is also similarity in wing pattern to that of *C. marmoratus* from which the pale areas at the extremities of the branches of the media are still distinctive and the single sensory pit on the third segment of the palp is in contrast to the multiple pit of *C. marmoratus*.

Description.—From the type series. No pinned material available for coloration details. Measurements from the holotype and selected series comprising six paratypes. Male measurements from allotype only. (See Table 1.)

Female.

The slide specimens reveal that the legs have pale spots preapically on the femora and also adjacent to the bases of the tibiae. The wings have a complex pattern of moderately strong contrast (Plate ix, fig. 4) and the halteres are pale.

Head: Eyes rather closely approximated (Text-fig. 4). Antennae rather short, with basal segments cylindrical (3–10) and distal five scarcely longer except the apical one, and hence no obvious contrast between proximal and distal segments (Text-fig. 20). The third segment of the palp (Text-fig. 12) is only slightly enlarged, with greatest width at about two-thirds from the base with a single distinct sensory pit apically. The mouthparts are scarcely as long as the height of the head.

Thorax: Legs with no obvious modifications, tarsus IV subcylindrical, tibial comb of four spines.

Abdomen: Two fully-formed subspherical spermathecae, each with a short duct and two additional ducts, one of which may be slightly expanded to appear like a deflated balloon (as in holotype). (See Text-fig. 27.)

Male.

This sex has not been taken.

Distribution.—Queensland: Yelarbon, turn off ½ mile on Texas Rd., suction trap, 1800–0045, 27:iii:1952 (A. L. Dyce); Texas, 20:i:1952 (A. L. Dyce); Texas, 26:iii:1952 (type series). New South Wales: "Baronga", Barwon R.–Boomi, suction trap, 19:xii:1951 (A. L. Dyce); Noonameena, light trap, 20:x:1952 (A. L. Dyce); Moree, 30:x:1951 (A. L. Dyce), mercury vapour light trap, 2130–dawn, 20:iii:1952 (A. L. Dyce); Bundy, via Moree, light trap, 1:xi:1951 (A. L. Dyce); Bundy Cr. crossing, 6:xii:1951, light trap 0000–0200, 0200–0500, 7:xii:1951 (A. L. Dyce); Yagobie, light trap, 1915–2100, 3:xii:1951 (A. L. Dyce).

(ii) *Species in which the Distal Portion of the Second Radial Cell is Pale.*

Culicoides moreensis, n. sp.

Types: Holotype ♀ and six ♀ paratypes, all slide mounted. Of these one paratype in C.S.I.R.O. and Q.I.M.R., the rest in S.P.H.T.M.

Type Locality.—Moree, New South Wales. All specimens in type series taken biting man, 1600–1800 hours, 25:xi:1951 (A. L. Dyce).

Distinctive Characters.—Confusion of the wing pattern of this species may arise with *C. austropalpalis* and *C. subimmaculatus*, but from both of these it differs in having the end of the second radial cell pale.

Description.—From the type series. No pinned material has been available for details of coloration. Measurements are from holotype and selected series comprising six paratypes. (See Table 1.)

Female.

Legs with pale spots preapically on femora, subbasally on tibiae. Halteres pale. The wings (Plate ix, fig. 5) have a reduced rather inconspicuous pattern comprising two major pale spots, one over r–m, the other at the tip of the second radial cell and just including the apical portion of this cell. Rather more indefinite pale areas occur in the cubital fork and below the distal portion of Cu_1.

Head: Eyes separated (Text-fig. 5). Antennae (Text-fig. 21) with basal segments (3–10) subcylindrical, broader basally, last five segments obviously longer than the basal ones, so with moderate contrast between 3–10 and 11–15. Third segment of palp swollen, broadest at about middle, outer margin straight, inner very convex. The sensory pit is large, deep and opening on the distal half (Text-fig. 13). Mouthparts scarcely equal in length to height of head.

Thorax: Legs unmodified, tarsus IV subcylindrical, tibial comb of four spines.

Abdomen: Two fully formed spermathecae and two accessory ducts (Text-fig. 28).

Male.

This sex is not yet known.

Distribution.—Queensland: Texas, 28:xii:1951 (biting man). New South Wales: Moree, type series and 16:iv:1952, biting man (A. L. Dyce).

Culicoides bundyensis, n. sp.

Types: Holotype ♀, allotype ♂ and one ♀ paratype, all slide specimens in S.P.H.T.M.

Type Locality: Bundy, via Moree, New South Wales, 1:xi:1951, light trap (A. L. Dyce).

Distinctive Characters.—Except for having the distal portion of the second radial cell pale the wing pattern is reminiscent of *C. ornatus*. In the distribution of the differential wing pattern *C. bundyensis* is closest to *C. magnimaculatus* but the pattern is weaker and the pale areas in the centre of the wing are far more restricted.

Description.—From the type series and other specimens listed below. No pinned material available for details of coloration. Measurements from holotype and selected

series comprising one paratype and a specimen each from Texas and Moree. Male measurements from allotype only. (See Table 1.)

Female.

Legs with pale subapical femoral spots and similar subbasal tibial ones. Wings with definite pattern as in Plate ix, fig. 6.

Head: Eyes well separated (Text-fig. 6). Antennae with segments 3–10 cylindrical, 11–14 each longer than the basal segments but not markedly so, 15 distinctly longer (Text-fig. 22). Third segment of palp expanded in distal half, on which is situated the single large round sensory pit (Text-fig. 14). Mouthparts at least equal in length to height of head.

Thorax: Legs unmodified, tarsus IV subcylindrical, tibial comb of four spines.

Abdomen: Two fully developed subspherical spermathecae, each with short duct (Text-fig. 29).

Male.

Wing pattern similar to female but with almost no macrotrichiae. Male genitalia with simple harpes (Text-fig 36).

Distribution.—Queensland: Texas, 20:i:1952, light trap (A. L. Dyce). New South Wales: Moree, 30:x:1951 (A. L. Dyce); Bundy (type series).

Culicoides waringi, n. sp.

Types: Holotype ♀, allotype ♂, five ♀ and ten ♂ paratypes, all slide mounted. Of these, one ♂ paratype in each of C.S.I.R.O., Q.I.M.R., B.M. and U.S.N.M., the rest in S.P.H.T.M.

Type Locality.—Rottnest Island, near Fremantle (E. J. Reye, 23:viii:1954, 1000 hrs., net, among *Acacia* on dune near jetty).

Distinctive Characters.—This species is closely related to *C. magnimaculatus*, from which it may be distinguished by its larger size, the form of the palpal segments, particularly the second and third, and the details of the spermathecae.

Description.—From the type series. Measurements from holotype and selected series comprising five paratypes. Male measurements from six paratypes. (See Table 1.)

Female.

Legs with dark kneespots. Wings with large pale areas as in Plate ix, fig. 7. Halteres pale.

Head: Eyes widely separated (Text-fig. 7). Antennae with basal segments (3–10) subcylindrical, narrowing distally, last five similar in shape but obviously longer (Text-fig. 23). Third segment of palp expanded at middle, with large sensory pit on distal half (Text-fig. 15); segment V longer than IV. Mouthparts scarcely as long as height of head.

Thorax: Legs unmodified, tarsus IV subcylindrical, tibial comb of four spines.

Abdomen: Two spherical spermathecae each with a distinct duct and a small accessory duct (Text-fig. 30).

Male.

Similar to female except for usual sexual differences. Harpes long, slender and curved.

Distribution.—Western Australia: Only known from the type locality.

(b) A New Name and Additional Notes on Other Species.

Culicoides austropalpalis, nom. nov.

Synonymy: *Culicoides palpalis* Lee and Reye, 1953. Proc. Linn. Soc. N.S.W., 77 (1952): 380–1. Nec *Culicoides palpalis* Macfie, 1948. *Ann. Trop. Med. & Parasit.*, 42: 70, 78.

In describing *C. palpalis* we were not aware of the earlier use of the name *palpalis* by Macfie for a species from Mexico. We are indebted to Dr. W. W. Wirth for drawing

our attention to this preoccupation. Accordingly we now propose the name *austropalpalis* for the species originally described by us as *C. palpalis*.

Previously the known range of this species covered the area from Cape York in Northern Queensland to the vicinity of Sydney in New South Wales. We now know it to occur further south still. It has been taken at Colo Vale, near Mittagong, New South Wales, in light traps operated in November, 1953, and February, 1954, and at Black Mt., Australian Capital Territory, in light traps operated in October, November and December, 1953.

This species is occasionally taken in a sweep net but otherwise its presence is only detected by the use of light traps in which it may be taken in large numbers in favourable areas.

Apart from the variation in the wing pattern noted in the original description we have since noticed a rare variation in a specimen from Bundy Cr., New South Wales (7:xii:1951, A. L. Dyce); this is the presence of another large spermatheca in addition to the two large and one small spermathecae normally present in this species.

CULICOIDES MAGNIMACULATUS Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.S.W., 77 (1952): 388-9.

Further collections in New South Wales have confirmed the widespread occurrence, often in large numbers, of this species. It is taken attracted to man, biting, in light traps and by net sweeping. Its range into southern Queensland is extended west to Longreach and it has been taken in numbers at Peel I. In the mountain country of north-eastern New South Wales it has been taken at Mt. Warning (E. N. Marks) and also at Mulimbimby and on the Clarence River (B. McMillan). In the Australian Capital Territory specimens have been examined from Canberra, Black Mt. (some on horse, 18:i:1952, R. Mykytowycz) and from Tidbinbilla (some on cattle, 20:i:1953, R. Mykytowycz). It has also been taken feeding on a rabbit (between Gravesend and Terry Hie Hie, northern New South Wales, 28:ix:1952, A. L. Dyce). In Victoria it is recorded from the Grampians (B. McMillan) and Gifford, Lake Denison and Tidal River (G. W. Douglas). Its range in Tasmania has been extended to Port Davey (biting man and dog at dusk, 8:ii:1954, E. N. Marks).

The Victorian and Tasmanian material shows a variation in the wing pattern which appears to be present in increasing proportion the further south collections are made. This variation is in the shape of the intercalary pale area which shows varying degrees of indentation producing an effect resembling the three pale areas such as are found in *C. dycei*, *C. multimaculatus*, *C. mcmillani* and *C. marksi* but running together at their adjacent borders. These variants can be distinguished from *C. marksi* by its possession of two pale areas in cell M_4 and three incompletely chitinized spermathecae, from *C. mcmillani* and *C. dycei* by their lesser extent of pale areas on the wing generally and by the form of their antennae, and from *C. multimaculatus* (with which the variants seem most likely to be confused) by the form of the third segment of the palp.

From Fisher I., Bass Strait (15:iv:1954, R. Mykytowycz) comes an extreme variant in which the intercalary pale area is completely divided into two very unequal portions, the lesser being a small oval area towards the distal end of the lower branch of the intercalary fork, the greater being bilobed and proximal in position.

One specimen is aberrant in its spermathecae (from Gifford, Victoria) there being three large, subequal, subspherical spermathecae instead of two.

CULICOIDES IMMACULATUS Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.S.W., 77 (1952): 375.

The range of distribution of this northern species is extended in Torres Strait to Goode I., Saibai I., Prince of Wales I. and Jacky Jacky Cr. on Cape York Peninsula. It has also been taken on Low I. and Woody I. off the east coast of Queensland.

We have also examined pinned material from Mabuiag I. in Torres Strait which shows this species to be entirely lacking in scutal pattern, the scutum being a fairly uniform dark brown with the scutellum lighter brown.

CULICOIDES ORNATUS Taylor.

Taylor, F. H., 1911. *Rept. Aust. Inst. Trop. Med.*, 73. Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.SW, 77 (1952): 381–2

This coastal species is now known to extend to Saibai I., Boigu I. and Prince of Wales I. in Torres Strait, and to Woody I. in Hervey Bay, Green I. and Victoria Point in Moreton Bay (all the above being Queensland localities) and the latter is now the recorded southern limit for this species. One of the specimens from Saibai I. has three subequal subspherical spermathecae instead of the two normally present in this species. Specimens from Port Samson, near Roeburn (27:ii:1954, E. P. Hodgkin) extend the southern range of this species in Western Australia.

CULICOIDES MARMORATUS (Skuse).

Skuse, F. A., 1889. PROC. LINN. SOC. N.S.W., 4 (2nd series): 304–5 (*Ceratopogon*). Macfie, J. W. S., 1939. PROC. LINN. SOC. N.S.W., 64: 556. Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.S.W., 77 (1952): 382–3.

The range of this coastal species is extended to Woody I., Fisherman I., and Stradbroke I., in Queensland.

CULICOIDES SUBIMMACULATUS Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.S.W., 77 (1952): 375–80.

This coastal species is now known to extend beyond its previously recorded range to Port Douglas (Queensland) and Albany Passage (Torres Strait, North Queensland). Off the east coast of Queensland new localities are Woody I. and Green I. In southern Australia it has been taken at Lake Denison, Victoria and Yorke Peninsula, South Australia.

CULICOIDES MOLESTUS (Skuse).

Skuse, F. A., 1889. PROC. LINN. SOC. N.S.W., 4 (2nd series): 305 (*Ceratopogon*). Kieffer, J. J., 1906. Chironomidae in *Wytsman's Genera Insectorum*, fasc. 42: 54. Macfie, J. W. S., 1939. PROC. LINN. SOC. N.S.W., 64: 556. Lee, D. J., and Reye, E J., 1953. PROC. LINN. SOC. NSW, 77 (1952): 382

The range of this coastal species is extended in Queensland by its capture at Woody I, Maroochy R., Currigee and Southport, and in New South Wales at East Ballina.

CULICOIDES DYCEI Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.S.W., 77 (1952): 390.

Previously known from southern Queensland and northern New South Wales, specimens have since been captured at Colo Vale (near Mittagong, New South Wales) and in the Australian Capital Territory.

The presence of this species is usually revealed by light trap collections, but it has also been taken from rabbits and horses.

CULICOIDES MARKSI Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.S.W., 77 (1952): 392.

The distribution of this species is extended northwards to Magnetic I. and westward to Noondoo in Queensland, and it has been taken at additional localities within its known range at Greenslopes (biting man) and Yeerongpilly in Queensland, and Gravesend and Colo Vale in New South Wales, and at Black Mt. and Tidbinbilla in the Australian Capital Territory (the latter on horse and biting man).

CULICOIDES MULTIMACULATUS Taylor.

Taylor, F. H., 1918. *Aust. Zoologist*, 1: 169. Macfie, J. W. S., 1939. PROC. LINN. SOC. N.S.W., 64: 556. Lee, D. J., and Reye, E. J., 1953. PROC. LINN. SOC. N.S.W., 77 (1952): 390–1.

Additional information on this species has been provided by a long series of specimens collected by B. McMillan at King Lake (Victoria), 1900–2000 hrs., 15:xii:1953. A few of these were taken biting man, most were aspirated in flight. Further series were collected by G. W. Douglas at Gifford, 1930 hrs., 10:ii:1953, biting man and at

Lake Denison (north-east of Yarram), 1930 hrs., undated. Both these localities are also in Victoria.

We are now able to illustrate the interorbital space (Text-fig. 8), the spermathecae (Text-fig. 31) and correct a misinterpretation of the palpal sensory organ (Text-fig. 16). In the badly mounted head of the holotype (previously the only known specimen) the palpal organ appeared to comprise three irregular pits; in the fresh material it is obvious that these are fused into one large, very irregular pit, which is internally divided by ridges.

As the holotype was not satisfactory for full measurement, measurements are now given for a specimen from Lake Denison (461) and a series of six specimens from Gifford and Lake Denison. (See Table 1.)

Culicoides antennalis Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. Proc. Linn. Soc. N.S.W., 77 (1952): 386–7.

The range of this species is now known to extend to Colo Vale, near Mittagong, New South Wales.

Culicoides bancrofti Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. Proc. Linn. Soc. N.S.W., 77 (1952): 387–8.

The range of this species is extended to Colo Vale, near Mittagong, New South Wales (taken February, April and November, 1953) and to Hall's Gap in the Grampians, Victoria (taken from calf, 1900–20000 hrs., 22–25:xii:1953, B. McMillan).

Culicoides angularis Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. Proc. Linn. Soc. N.S.W., 77 (1952): 384–5.

The range of this rather rare species is extended to Black Mt., Australian Capital Territory (light trap, 2:xi:1953, A. L. Dyce).

Culicoides mcmillani Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. Proc. Linn. Soc. N.S.W., 77 (1952): 391.

The range of this species is extended north to Peel I., Queensland (taken in net, 11:x:1951) and south to Wilson's Promontory, Victoria (biting man at Tidal R., 2:iii:1953).

Culicoides parvimaculatus Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. Proc. Linn. Soc. N.S.W., 77 (1952): 391–2.

The range of this species is extended south to Colo Vale, near Mittagong, New South Wales.

Culicoides magnesianus Lee and Reye.

Lee, D. J., and Reye, E. J., 1953. Proc. Linn. Soc. N.S.W., 77 (1952): 385.

This species was previously only known from Magnetic I., the type locality. Recently it has been found in the Torres Strait, where it has been taken in numbers coming to light on Moa I. (M. J. Mackerras and E. N. Marks) and biting man on Horn I. (J. Menner). It has also been collected south of the type locality at Woody I. in Hervey Bay, Fisherman I. and Peel I. in Moreton Bay (all localities in Queensland).

Among specimens from Moa I. were several which were found to have an additional large subspherical spermatheca (three instead of two). This may represent full expansion of the end of the isolated duct mentioned in the original description.

Having noted the close similarity of *C. magnesianus* with the description of *C. cordiger* Macfie from Negri Sembilan, Malaya (*Ann. Trop. Med. & Parasit.*, 28: 193–4) we asked Dr. Freeman at the British Museum to compare the two species. He replied that he could "find no differences in proportions of antennal segments, colour and proportions of legs, spermathecae, halteres or wings. They resemble each other in appearance."

It seems possible that the two species may be the same, but as in our experience palpal differences may be critical it would seem wise to wait until the Malayan species is more adequately known, and males compared, before committing *magnesianus* to synonymy.

3. The Genus Lasiohelea.

Kieffer, J. J., 1921. *Arch. Inst. Pasteur de l'Afrique du Nord*, 1: 115. Kieffer, J. J., 1925. Faune de France, II, Dipteres Chironomidae Ceratopogoninae: 49. Edwards, F. W., 1922. *Bull. ent. Res.*, 13: 166–7. Ingram, A., and Macfie, J. W. S., 1924. *Ann. Trop. Med. & Parasit.*, 18: 377-92.

In an earlier paper (Lee, 1948) *Lasiohelea* was mentioned as a member of the *Forcipomyia* group. Most authors place the genus as intermediate between *Forcipomyia* and *Atrichopogon* and ascribe to it the venation of the latter associated with the wing vestiture of the former. For example, Kieffer's original definition (1921) was as follows: "Alar pilosity as in *Ceratopogon*; [that is, *Forcipomyia*] "empodium as long as the claws with short hairs; the rest as in *Atrichopogon*. Type *Atrichopogon pilosipennis* Kieff." Later (1925) Kieffer expanded this to "Intermediate between *Forcipomyia*, of which it has the wing pilosity, and *Atrichopogon*, of which it has the venation; costa passing the middle, second [i.e. third] segment of the palp the longest, first, third and fourth [i.e. second, fourth and fifth] short, except in *L. silesiae* n. nov. (*Pilosipennis* Kieffer ♂ not ♀, of which the fourth [i.e. fifth] is the longest. Type L. *pilosipennis* ♀."

Edwards (1922) and Ingram and Macfie (1924) discuss the characters of the genus in greater detail but add little in the way of distinctive generic characters other than a character of the wing fringe which Ingram and Macfie state to be composed of long hairs between two rows of shorter oblique hairs, not as in *Atrichopogon* of practically a single row of alternating long and short straight hairs.

In our limited experience with this genus we do not consider that there is ever likely to be confusion between it and *Atrichopogon*, as the density of the macrotrichia is always considerably greater in *Lasiohelea*. On the other hand, there is room for confusion between *Lasiohelea* and both *Forcipomyia* and *Dasyhelea*. The latter, of course, is distinct in the absence of an empodium, but the form and distribution of macrotrichia, particularly in the tendency to develop bare lines on either side of the wing veins, may be quite close to that of *Dasyhelea*. Similarly, the possession of short blunt spines on the distal antennal segments is common to both *Dasyhelea* and *Lasiohelea*. In *Forcipomyia* the distribution of macrotrichia is almost completely uniform over the wing surface and the second radial cell is not elongated. Indeed the most characteristic feature of *Lasiohelea* appears to be the elongation of the second radial cell associated with a distinct upward curve of R_{4+5} from r–m almost to the wing margin.

In all, more than 50 species have been placed, at one time or another, in the genus *Lasiohelea*, and at the present time about 47 are still ascribed to the genus. A few of the better known of these are blood-sucking pests but a few others have been taken attacking various other insects, although some at least of the latter do not appear to be typical members of the genus. Despite this number of species most authors are constrained to remark on the difficulty of differentiating species, and this also has been our experience.

One species only has so far been described from Australia (*L. townsvillensis*) but the genus is now known to occur widely in Queensland and New South Wales and is also known from Western Australia. We have also examined material from various localities in New Guinea, and from New Britain and New Ireland. Our concern has been to try to establish whether or not more than the one previously described species is involved in these collections and whether or not any of the specimens before us might be identical with the more notorious *L. stimulans* from Sumatra or *L. lefanui* from the Ethiopian region. A review of the literature and examination of the material available to us has convinced us that clarity on these points cannot be arrived at for the time being and only by a comparative treatment of adequate material from many sources can there be any hope of achieving these ends. Nevertheless, in view of the possibility of *Lasiohelea* spp. being responsible for the transmission of certain diseases of cattle and of the recent remarks by Muirhead-Thomson (1954) concerning *Lasiohelea* as so-called "eye-flies" it is important that the specific status of the more prominent members of the genus be clarified.

LASIOHELEA TOWNSVILLENSIS (Taylor).

Taylor, F. H., 1918. *Aust. Zoologist*, I, Pt. 6: 169 (*Culicoides*). Macfie, J. W. S., 1939. PROC. LINN. SOC. N.S.W., 64: 558.

Type: There does not appear to be any specimen in existence actually designated as type of this species. There are four slides in S.P.H.T.M., obviously of the material originally examined by Taylor, including one which has been remounted by Macfie. As most are fragmentary and none are particularly satisfactory as specimens we have refrained from designating a neotype from this series.

Type Locality.—Townsville, Queensland.

Distinctive Characters.—Since this species was originally placed in the genus *Culicoides* it was overlooked by Edwards (1922) when he said: "Of *L. stimulans*, the Museum has a specimen from Deli, Sumatra . . ., several from Peradeniya, Ceylon . . ., and a series of females, without doubt specifically identical with those from Ceylon, from various localities in Queensland, some collected biting or labelled 'troublesome sandfly' from Dr. T. L. Bancroft."

Later, Edwards (1928) further remarks: "The species of *Lasiohelea* are so similar in all parts of the tropics that it is difficult to suggest the exact affinities of this new species [*samoaensis*]. It seems, however, to have more resemblance to *L. stimulans* . . . than to *L. townsvillensis* (Taylor) of Queensland. From *L. stimulans* it differs in its smaller size, shorter antennae and dark mesonotal pubescence. I have also seen examples of undescribed species of *Lasiohelea* from New Ireland and New Britain, which seem allied but distinct from this Samoan form."

Macfie (1939) also remarks: "It [*townsvillensis*] resembles closely *L. lefanui* Carter, an African species, and may indeed prove to be conspecific. Very similar if not identical forms have been taken in Malaya and elsewhere."

The close resemblance of *L. townsvillensis* to both *L. stimulans* and *L. lefanui* has then been obvious to earlier authors. We have not seen *L. lefanui* but have had available reputed *L. stimulans* from Java, which are very similar to Australian material. In view of this, any distinctive characters which we might propose for *L. townsvillensis* are of little more than generic significance.

However, *townsvillensis* is a *Lasiohelea* with only one spermatheca, bare eyes, expanded third segment of the palp with a large sensory pit with a diameter of between one-third and one-half the length of the segment and largely in the distal half of the segment. The wing length approximates 1·0 mm. or very slightly less, R_{4+5} terminates well beyond the middle of the wing, and the tarsal ratio is about 2·0.

We have refrained from illustrating this species, as we feel that only comparative figures of closely related species can now be of any real value.

An examination of the male genitalia of specimens from Magnetic I. and Proserpine has revealed no appreciable differences from the illustrations of the genitalia of *L. nigeriae* (Ingram and Macfie, 1924, p. 382) or *L. stimulans* (Macfie, 1934, p. 207). Nevertheless a critical examination of carefully dissected material may yet reveal some differences of diagnostic value.

Distribution.—QUEENSLAND: Bramston Beach, Inwoods Camp, N.Q., 9:ix:1949 (M. J. Mackerras); Bramston Beach, Babinda, N.Q., 14:ix:1949 (hovering close to ground in forest); The Boulders, Babinda, 11:ix:1949 (I. M. Mackerras); Harvey Cr., N.Q., 15:ix:1949 (I. M. Mackerras); Magnetic I., 9:vii:1952 (E. J. Reye, 0930 hrs., net, Horseshoe Bay mangrove swamp and 1100 hrs., net, freshwater swamp); Townsville (W. J. Young); Proserpine, 15:vii:1952 (E. J. Reye, 0840 hrs., net, freshwater pool near stockyard, 4 m. S.); Gin Gin, 5:vii:1952 (E. J. Reye, 1530 hrs., biting man in sunlight); Fraser I., 15:ii:1949 (hovering around head, biting occasionally, rain forest); Pialba, 27:ii:1938 (biting in daylight); Eidsvold, 2:iv:1924 (T. L. Bancroft); Chinchilla (J. Mann); Chinchilla, 13:xii:1949 (F. H. S. Roberts, ex horse); Imbil, Brooloo forest, 29:vi:1938 (biting in daylight); Burpengary–Morayfield, 28:viii:1951 (1345 hrs., biting man); Deception Bay, 28:viii:1951 (E. J. Reye); Camp Mt., Brisbane, 19:vi:1938 (R. V. Smythe), 3:vii:1954 (E. N. Marks); Cedar Cr., Upper Kedron, near Brisbane,

30:iv:1950; Branch of Ithaca Cr., Mt. Cootha, 9:ix:1950 (J. Pope); Brisbane, 24:iii:1941 (biting in daylight); Yeronga, 23:ii:1954 (E. J. Reye, 1200 hrs., hovering and biting man); Blunder Cr., Oxley, 14:v:1950 (M. J. Mackerras); Sunnybank, 19:viii:1950; Runcorn, 9:iv:1954 (W. Dowd. on goats); Creek near Boonah turnoff from Cunningham's Gap Rd., 23:iv:1950 (M. J. Mackerras); Victoria Pt., 11:ix:1954 (M. J. Mackerras); Nunimbah Valley, 19:iii:1950 (M. J. Mackerras, in dense jungle cave, biting), 9:viii:1952 (M. J. Mackerras, biting man); Lamington, O'Reilly's, 14:viii:1954 (B. McMillan, biting); Currigee, 3:v:1953 (E. J. Reye, 1700 hrs., net, mangrove shore line); Texas, 16:iv:1953 (A. L. Dyce, 1200 hrs. and 1600 hrs., biting man). New South Wales: Mt. Warning, 10:vii:1954 (E. N. Marks); Byron Bay, 27:vi:1954, 25:vii:1954 (B. McMillan, biting); Lismore (P. H. Durie); Casino, 5:viii:1954 (B. McMillan, biting on ears); Barrington Brush, 7:iii:1951 (B. McMillan, 1400 hrs., biting on legs, 1200 ft.); Williams R., 18:iii:1952 (B. McMillan, some biting, 1500 ft.); Cooranbong, 26:ii:1950, 1:vi:1951 (B. McMillan); Cowan Cr., 27:x:1949 (B. McMillan); Hornsby, 8:x:1950 (B. McMillan), 5:ix:1954 (E. J. Reye, 1545 hrs., net in gully); Cox R., 6:v:1954 (some biting on legs); Springwood, 16:iv:1950 (B. McMillan, biting).

Apart from the above we have also seen a single specimen of *Lasiohelea* from the north of Western Australia (Kulumburu, 11:iii:1954, E. P. Hodgkin) which we cannot place in *townsvillensis*, as the third segment of the palp is longer than in the eastern Australian form and the sensory organ is no more than one-quarter the length of the segment.

From the New Guinea area the following material has been examined: Biak, D.N.G., —:i:1945 (W. R. Horsfall); Kanosia, Papua, 5:vi:1947 (R. H. Wharton, biting, 1400 hrs., in bush); Eilogo, Papua, 2:vi:1947 (D. J. Lee, on cattle); Samarai, Papua (F. J. Williams); Keravat, New Britain, 11:viii:1953, 7:xii:1953 (G. S. Dun). None of this are we prepared to identify as *L. townsvillensis*, but the only differences we can detect are that the segments of the palps tend to be slightly smaller and the antennal ratio slightly higher in the New Guinea material. Otherwise there is very close similarity to *L. townsvillensis*.

It should also be noted that Muirhead-Thomson (1954) notes that Dr. Freeman has advised that specimens of *L. lefanui* var. *squamipes* have been received from New Britain (in the British Museum).

References.

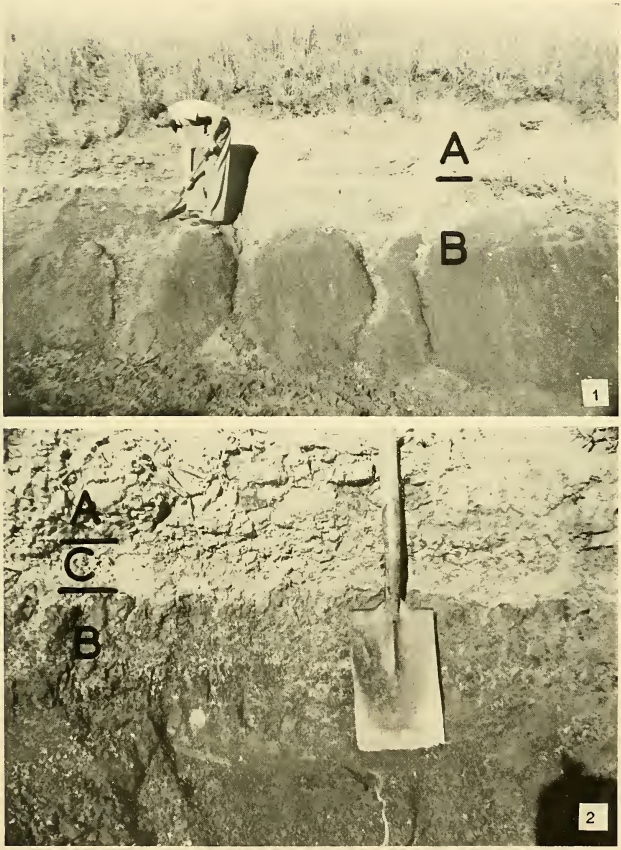
(Most systematic references are quoted in full in the text.)

Edwards, F. W., 1928.—Insects of Samoa, Part vi. Diptera, fasc. 2. Nematocera: 51.
Lee, D. J., 1948.—Proc. Linn. Soc. N.S.W., 72 (1947): 313-331.
Muirhead-Thomson, R. C., 1954.—*Ann. Trop. Med. & Parasit.*, 48: 121.
Wirth, W. W., 1952.—Univ. Calif. Pub. in Entom., Vol. 9, No. 2: 95-266.

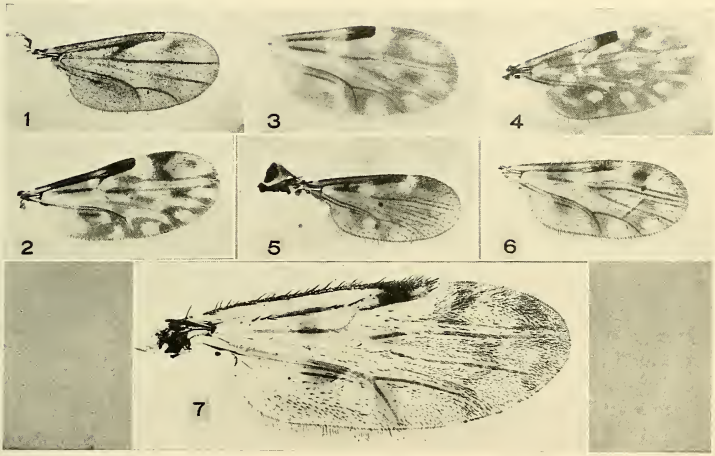
EXPLANATION OF PLATE IX.

Wings of various species of *Culicoides* (×30 approx.): 1, *C. coronalis*. 2, *C. williwilli*. 3, *C. nattaiensis*. 4, *C. bunrooensis*. 5, *C. moreensis*. 6, *C. bundyensis*. 7, *C. waringi*.

Figures 2, 3, 4, 6 and 7 are from the holotypes, 1 is from a paratype (392), and 5 from a paratype (387).



"Anomalous" krasnozem at Fairy Hill.



Wings of species of *Culicoides*.